Learning from the Past: Traditional Knowledge and Sustainable Development

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As environmental concerns reach the top of political agendas throughout the world, questions about how to avoid further environmental degradation or how to protect threatened habitats and preserve endangered species of plants and animals from imminent extinction gain ever more prominence in development planning. The idea that respect for the long-term requirements of nature must be incorporated into development projects is inherent in the now popular term "sustainable development," which has been so widely promulgated by the United Nations' Brundtland Report, published as *Our Common Future* (World Commission on Environment and Development 1987).

In the Pacific, these sorts of environmental concerns recently found strong expression at the Fourth South Pacific Conference on Nature Conservation and Protected Areas, which was organized by the South Pacific Regional Environment Programme (SPREP) and held at Port Vila in Vanuatu in September 1989. One of the topics focused on by the conference was the value of traditional knowledge and resource conservation as a basis for sustainable development in the Pacific. In its original form, this article was the theme paper for this topic; in its revised form here, it incorporates points raised at the conference, especially those that will be included in SPREP's forthcoming Action Strategy, which will include a set of goals, objectives, and activities intended to enhance nature conservation and protected areas in the region.

In their effort to incorporate traditional knowledge and resource-management systems or techniques into modern life, Pacific Island governments face a development dilemma, which Graham Baines has written about with particular regard to the traditional resource-management systems that are based on communal-property concepts:

The Contemporary Pacific, Volume 2, Number 2, Fall 1990, 233–253

> Independent Pacific island governments accept that these systems, being expressions of social structure itself, are basic to the continued welfare of their societies. At the same time these governments are proceeding to implement forms of economic development which are in conflict with these traditional systems. This poses a development dilemma which is crucial for the future of the people of the South Pacific islands. To what extent can the traditional systems accommodate further change? Will serious efforts be made to adjust approaches to economic development so as to ease those disruptions to traditional resource-management systems which are eroding Pacific island societies themselves? (Baines 1989, 273)

A similarly perplexing predicament in the contemporary Pacific resides in the widespread belief, often expressed by political leaders, that planners, conservationists, and resource managers and scientists have much to learn environmentally from a study of traditional knowledge and management techniques. The traditional aspects are valued rhetorically and politically, but also because it is believed that traditional ways have fundamental conservationist (and social) merit—a view affirmed by all governments of the SPREP region in 1982 when they declared: "Traditional conservation practices and technology and traditional systems of land and reef tenure adaptable for modern resource management shall be encouraged. Traditional environmental knowledge will be sought and considered when assessing the expected effects of development projects" (SPREP 1982, 34).

Almost everyone knows, however, that there are operational and conceptual puzzles to be overcome in effecting the integration of lessons from the past into the resource-management systems of today. For one thing, techniques or materials, just because they are traditional, are not always more durable or more favorable to conservationist management than modern replacements or innovations. In any case, the villager, as a resource manager on the ground, may be driven in this cash-demanding world to use whatever ways are easily available, effective, labor-saving, and cheap, whether traditional or modern, whether conservationist or devastating. Conceptually, the planners, the urban-based conservationists, and the scientists (many of whom are expatriate) are separated from the traditional world and may romanticize the past ecological relations between people and place.

In the next section, I shall examine this question of just how environmentally sound traditional knowledge and management were. I shall then consider some examples of knowledge and techniques that might usefully

be borrowed from the past and strategies that can help to integrate past knowledge into present development. Finally, I shall offer some thoughts about the environmental ethics and attitudes of past Pacific Islanders and what these have to offer today's world.

The Past as a Model for Sustainable Development?

What Kirch has said about Polynesia holds true for all of prehistoric Oceania (1984, 123). The early inhabitants did not avidly practice a conservation ethic that preserved their habitat as an unchanged paradise until the advent of Europeans brought major disturbances and degradation. Instead, the Islanders did what all peoples, especially pioneers, do: in their efforts to make a living they actively manipulated, modified, and, at times, degraded the ecosystems they lived in, producing environmental changes that in turn required ecological adaptations and social adjustments.

It has been acknowledged for decades that the pre-European "moa hunters" and Maori of New Zealand exercised massive effects on the forests and bird life of these southernmost islands of Polynesia. These first human settlers in New Zealand played the primary role in the extinction of a unique group of birds and in greatly reducing forest cover, particularly by fire (Cumberland 1961; 1962; 1963). It is now recognized that the early human occupants of all Oceania similarly affected plant and animal life (terrestrial and marine), caused soil erosion, and in some cases significantly modified even the geomorphology of their islands.

Reviews of published research on these environmental dynamics are provided by Kirch (1984, 123–151), Clarke (1986), and Blaikie, Brookfield, and Clarke (1987). Considering the whole landscape, the most widespread of the human-induced changes in the prehistoric Pacific has been deforestation, with the cleared forests often being replaced by fire-maintained fern-grassland savannas, usually underlain by infertile, eroded, or truncated soils. This distinctive plant-soil complex is known as *toafa* in several Polynesian islands and as *talasiga* in Fiji. The dominant plants are the ferns *Dicranopteris linearis* and *Pteridium esculentum* with scattered occasional scrub pandanus and casuarina trees. Generally today these areas are avoided by cultivators because they are too unproductive and too prone to further erosion. The origin of the *talasiga* complex has been argued by Latham (1983) to be prehuman in the Pacific, but its extension,

usually accompanied by evidence of fire and massive accelerated erosion, is linked to forest clearing by early settlers, as documented from many parts of the Pacific, for example Lakeba (Fiji), Aneityum (Vanuatu), New Caledonia, Futuna, 'Uvea, Tahiti, and Hawai'i (Spriggs 1981; Kirch 1984; Latham et al 1983).

These dramatic landscape changes, which would appear at first sight to have been unmitigated and gross environmental degradation, subsequently brought to many islands what Spriggs termed "landscape enhancement," whereby the eroded soil, transported down the slopes, filled in the lower parts of valleys and created swampy valley floors that were ideal sites for what came to be sustained-yield, intensive cultivation of wetland taro (Spriggs 1985). It is interesting to conjecture how a prehistoric environmental impact assessment would have balanced the inadvertent gains of an increase in fertile lowland soils against the degradation brought by forest clearing, burning, and gardening on slopes vulnerable to massive erosion. It is worthwhile to note that today in Fiji there has been at least a partial rehabilitation of the degraded *talasiga* lands by large-scale plantings of the exotic pine *Pinus caribaea.*

Our increasing knowledge of the prehistory of the Pacific Islands shows the Islanders living in dynamic environments, subject to natural hazards and change, as well as to potent human actions. In their transformations of natural landscapes into cultural landscapes, the early inhabitants of the Pacific brought about many extinctions, endangered other species, and degraded soil, vegetation, and reef. But they also—partly as a result of, or in response to, self-inflicted degradation—developed sustained-yield systems of agriculture, agroforestry, and reef use that still operate productively today, but are in danger of disappearing in the face of changing technological, social, and economic conditions. In equal danger of being lost is much of the enormous amount of detailed knowledge about local resources of plants and marine life still held in the minds of a declining number of traditional resource managers. Arthur Dahl has described, with specific reference to New Caledonia, some of the reasons for the loss of this traditional heritage:

> Children are no longer educated in the family or the tribe, but in schools where western-style education gives little time to traditional cultures. Traditional patterns of social organization for collective action have been disrupted, making it impossible to continue group occupations such as collective fishing or the irri-

> gated cultivation of taro. New occupations in towns, mines or commercial agriculture have attracted the most able, and reduced the extent of traditional subsistence activities. Traditional knowledge no longer passes automatically from father to son or mother to daughter. Even where subsistence activities have continued, new technologies have replaced old, and the old knowledge has seemed superfluous even where it would still be useful. The technological fix is an easy temptation for all societies. (Dahl 1985, 1–2)

On the other hand, quite a bit of traditional knowledge has been or is being recorded, but in a sporadic way, scattered over hundreds of years and thousands of publications based on observations by geographers, anthropologists, biologists, agriculturalists, administrators, and early European explorers, artists, and natural scientists. Klee provides a good review of what has been written on traditional resource management in Oceania up to 1980 (Klee 1980*a*). Further coordination and a more up-to-date set of references will be brought to this endeavor by the Conference on the Science of Pacific Islands Peoples that will be held at the University of the South Pacific in Suva, Fiji, in December 1990.

Preservation of traditional environmental knowledge is a clear necessity. Less clear is how to integrate that knowledge and associated techniques and customs effectively and usefully into today's search for sustainable resource management. The past offers no panacea to present-day environmental problems facing the Pacific such as inshore marine pollution, disposal of domestic waste, forest loss, soil erosion, or endangered species (Dahl 1984). But there are valuable sets of knowledge and useful components of past sustained-yield systems that could serve to help, at least to some extent, now, when modern technologies, rapidly growing populations (on some islands), and the development imperative all act to increase the magnitude and speed of environmental damage.

Learning from the Past: Knowledge, Techniques, and Customs

There is no need here to duplicate Klee's review of traditional knowledge, techniques, or customs as these relate to environmental management in the Pacific Islands (Klee 1980*a*). Since he published his review, several conferences and workshops have focused on various aspects of traditional environmental knowledge (for example, Morauta, Pernetta, and Heaney 1982; Ruddle and Johannes 1985; Thomas 1989).

To show the richness of the traditional heritage, a few examples will be drawn from agriculture, and the use of trees and marine resources. All demonstrate the merits of traditional knowledge. First, because it is derived from long-term observation over many annual cycles, seasonally recurrent processes as well as irregularly occurring events are known. This contrasts with the less complete knowledge gained by quick resource surveys undertaken over a few weeks or less. Second, traditional knowledge is fine scale, based on intimate knowledge of local variation and repetition of phenomena, and thus usually considerably more detailed than surveys carried out in broad brush over larger areas. These merits also contain the potential disadvantage that in being site-specific the local knowledge may be useful only locally.

Agriculture

The time has passed when traditional agricultural systems were generally condemned as primitive and inefficient except by the few field anthropologists and geographers who had studied them. The merits of traditional polycultures, the often high energy-return rates of nonindustrial agriculture, the avoidance of agricultural toxins, the maintenance of genetic diversity, the fine-scale planting of specific crops in microhabitats, the often high elasticity of supply—all of these and more can be seen as benefits (ecologically if not economically) compared with the contrasting costs of industrialized agriculture.

Even in the harsh environment of atoll islets, sustained-yield agroecosystems exist, most notably the wide use of food-and-drink-supplying trees and the unique pit-excavation cultivation of *babai (Cyrtosperma chamissonis),* the largest of the taro family. On atoll islets, where the only fresh water is found in the subsurface lens, *babai* is cultivated by digging pits, often over four feet deep, into the coral rock or rubble to reach the lens. To compensate for the lack of mature, fertile soils on atoll islets, the young *babai* is planted in the pit inside a bottomless basket woven of coconut or pandanus leaves; the basket is then filled with a mixture of soil and dried compost made from the leaves of breadfruit and several wild trees and herbs such as *Guettarda speciosa, Hibiscus tiliaceus,* and *Triumfetta procumbens.* By means of these sunken gardens, which are spread widely across the Pacific, a swamp plant wholly unsuited to the natural atoll environment of limited fresh water and poor or absent soils was made capable of producing sustained yields of a staple food by means of

an ingenious modification of the surface topography and the use of local organic materials as soil-producing fertilizers (Klee 1980*a*, 251–253; Barrau 1961, 42–44; Small 1972, 65–70; Watters and Banibati 1984, 83–86). A marked decline in the number of functioning *babai* pits and in knowledge of the many varieties of *babai* has been reported from Abemama Atoll in Kiribati (Watters and Banibati 1984, 83–86). Almost certainly, a similar decline in the potential self-sufficiency of island communities has been occurring over the whole range of *babai* cultivation as there has come to be a greater reliance on store foods and a lessening interest in good maintenance of the cultivation pits.

Many other equally sophisticated and sustainable agricultural methods have existed and are suffering a decline, for example, the widespread cultivation of irrigated taro *(Colocasia esculenta)* in terraces on high islands. Klee has noted the potential value of all these traditional soil and water conservation techniques and urges present-day resource managers not to view the traditional methods as obstacles to modernization; rather, they should spend time to revive and, by means of modern science, improve them. "The whole idea would be to take an existing culturally acceptable practice and modify it only slightly to make it more productive or efficient, thus hopefully avoiding any disruptive side effects" (Klee 1980*a*, 274; Klee 1980*b*, 285). In some ways this sort of "progressing with the past" (Clarke 1978) seems feasible in the Pacific in regions where the erosion of traditional knowledge has not been too great. Rural Pacific peoples are generally not so pressed against the edge of survival that they cannot risk innovation, and the small islands or small-scale tenure systems encourage or make possible experimentation on a limited scale. But, as already intimated, young people are not always interested in taking up this sort of approach, and there are all sorts of pressures against government agencies supporting it operationally, no matter what the local development plan may urge.

Agroforestry, Arboriculture, and the Use of Wild Trees

In Pacific communities, a major contribution to ecological stability, to food supply, to the supply of useful materials, and to the beauty and health of landscapes has always been made by the planting or protection of trees as integral components, in time or space, of polycultural agricultural systems. For example, one recent study of a variety of Pacific Island environments listed some fifty-six functions for trees, including categories

such as soil improvement, fuelwood, boatbuilding, wrapping, fiber and fabric, medicines, and perfumes (Thaman and Clarke 1987). Recognizable orchards have been described for many Pacific communities, for example, on Santa Cruz by Yen (1974) or the highland fringe of New Guinea by Clarke (1971, 80–82). Often, too, what looks at first glance like wild forest is really a humanized orchard in which almost all species are useful, and many trees and shrubs may have been planted or encouraged. Rather than being a compartmentalized sector of the economy as forestry is today, traditional arboriculture was an integral part of agriculture, housing, medicine, and the production of a wide range of material goods, while at the same time providing ecological services such as shade, erosion control, watershed protection, and habitats for wildlife. As Firth wrote of Tikopia half a century ago, "what appears to be bush is really a collection of trees and shrubs, each having its own value to the people, either for food or in their material arts" (Firth 1936, 375; see also Kirch and Yen 1982).

Other studies that stress the great range of uses for a wide variety of tree species include Lessa's (1977) study of the traditional uses of vascular plants on Ulithi Atoll; J. M. Powell's (1976) ethnobotany of New Guinea vegetation; and Thaman's recent study of the cultural utility of 140 species of Pacific plants widespread in mangrove and coastal vegetation. He found 69 different purpose or use categories, with a total of 987 individual uses for the 140 plants, an average of 7.1 uses per plant, ranging from no reported use for 4 species to 121 uses for the coconut if distinct uses within categories (e.g., tools with distinct functions) are counted (Thaman, forthcoming).

The most widely reported specific uses are medicinal, general construction, body decoration, perfume, fuelwood, ceremonial, cultivated or ornamental plants, toolmaking, food, cordage, boat or canoe making, food wrapping, fertilizer and mulch, animal feed, and handicrafts. The loss of this utilitarian diversity can be expected to lock Pacific Islanders more tightly into cultural and economic dependency.

The loss of the traditional forest resource that is now commonplace results from several processes. The most dramatic is commercial logging, which "liquidates a resource which may have served a lineage for many centuries, which harbours all of that line's historical links with the past, and which has traditionally been viewed as a resource borrowed from future generations" (Baines 1989, 282). Less dramatic, but perhaps of as great importance as deforestation is "agrodeforestation," a word as ugly as

the process; it means the disappearance and nonreplacement of the great variety of useful tree species that traditionally threaded through all the human landscapes of garden and village. Unlike the widespread deforestation of native rain forest or the clearing of mangroves for coastal development, agrodeforestation continues with little or no official recognition or resistance (Thaman 1988, 33). Once the species of trees are gone, the traditional knowledge of how to use them has only academic value; the other side of the coin is that the traditional knowledge of the uses of trees is eroding too, with less and less being transmitted from generation to generation. The great usefulness of forests and trees should also be kept in mind when parks or protected reserves are contemplated in "largely unused" areas; it may well be that the area under consideration is a living store of foods and materials and a source of a surrogate income in that it removes the need for cash expenditure for many necessities.

Marine Resources

Traditional knowledge of Pacific Islanders' great resource, the sea and reef, is legendary. Traditional master fishermen served as fisheries ecologists and conservation officers, studying the habits of all edible marine species and the state of the fishing grounds in order to protect an island's marine resources from overexploitation (Klee 1980*a*, 255). Johannes' book *Words of the Lagoon: Fishing and Marine Lore in the Palau District of Micronesia* (1981) beautifully illustrates the encyclopedic knowledge of practical sea lore possessed by traditional fishers, a knowledge that may still not be equaled by the scientific inventory of reef life in many island groups. Johannes has noted the rich knowledge of local fishers in the Pacific:

> Studying their knowledge during the past few years has provided a host of valuable insights into the nature of shallow-water tropical marine resources. Information obtained in this way is often superior in important respects to information gained by means of conventional resource surveys performed by imported consultants constrained by insufficient time and money. For example, what may look like an insignificant and relatively barren islet to a reserve planner during a site inventory made in one season, may be thronged with breeding sea birds, or in rarer cases, breeding sea snakes, in another. Certain otherwise unremarkable beaches may come alive with spawning land crabs during certain lunar periods and seasons or serve as rookeries for nesting sea turtles. (Johannes 1982, 258)

Such finely detailed knowledge gained by empirical observation over the cycles of many years made it possible for Pacific Island fishers to devise and practice "almost every basic form of modern marine conservation measure centuries ago, long before the need for marine conservation was even recognized in western countries" (Johannes 1982, 259). These measures included the use of closed seasons during spawning, closed areas, bans on taking small-sized catch, restrictions on the numbers of traps in an area, and—the most important of all fisheries management strategies—restricted entry to specific fishing grounds based on reef and lagoon tenure. The system was simple: the right to fish in a particular area was controlled by a clan, chief, or family, who regulated the exploitation of their own marine resources and avoided the depletion and degradation that results from unlimited free access to limited renewable natural resources—Garrett Hardin's now famous "tragedy of the commons" (Johannes 1978, 350–351; Hardin 1968).

With immense effort, the modern world has finally come to the same conclusion with regard to offshore waters and has established the Law of the Sea. Ironically, while the Law of the Sea protects the offshore waters of island nations from depredation by industrialized fishing nations, the inshore traditional conservation systems are breaking down because of the introduction of cash economies, the decline of traditional authority, and the imposition of countervailing laws and practices by colonial or independent governments. Only in some island countries, such as Fiji, Palau, Yap, and much of Papua New Guinea, are traditional rights protected through explicit or implicit legal recognition. Only in Fiji have traditional fisheries rights been systematically investigated and officially recorded and a procedure instituted for compensation for the loss of traditional fishing areas as a consequence of foreshore development and mangrove clearance. (See Baines 1989 and Johannes 1977, 1978, 1982 for a full discussion of the complexities of communal rights, limited access, and inshore fishing in the Pacific Islands).

As with terrestrial resources, the traditional conservation record with regard to marine resources is not perfect, which is only another way of saying that traditional Pacific Islanders were human. Johannes described the many conservation measures practiced, and noted that Micronesian fishers taught their apprentices that it was wasteful to catch more than was needed and that it was wise to let some fish escape from the nets in order to provide a continued breeding stock. He then went on to record

some of the less restrained traditional fishing activities found in various parts of the Pacific: harvesting porpoises for their teeth while letting the meat rot, overkill by indiscriminate use of fish poisons, uncontrolled harvesting of turtle eggs, and encircling a coral head with a net and then systematically breaking up the coral, thereby destroying the habitat in order to extract the fish (Johannes 1978, 353, 355).

Putting Traditional Knowledge to Use

How can traditional environmental knowledge, vast in amount and intricate in detail, be best put to use? And what traditional customs can help promote sustainable resource management and the establishment of protected areas? In their consideration of the implications and possibilities of the traditional knowledge base for contemporary Papua New Guinea, Lance Hill, John Pernetta, and Barney Rongap (1982, 352–359) suggested three major approaches:

> *Traditional knowledge in synthesis with introduced knowledge.* As has been illustrated in the work of many scientists, making use of traditional knowledge can quicken and deepen the development of an inventory of the physical and biological resources and the ecosystems of an area. Traditional knowledge can also be synthesized with introduced knowledge in environmental plans, project regulations, and environmental monitoring. The use of traditional knowledge can facilitate community participation, as in the wildlife management areas in Papua New Guinea (Eaton 1986). Traditional knowledge can make a significant contribution to mixed-cropping techniques and the development of agroforestry systems.
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> *Use of traditional environmental knowledge in education.* The main purpose here is to use ethnoscience in the schools to prevent the erosion of traditional knowledge and practice that follows the entry of children into formal schooling. Examples of the successful application of traditional methods to contemporary development could serve as case studies. "Educational programmes also need to be directed to other groups as well: bureaucrats and politicians on the one hand and village people on the other. Both, in their different ways, need to be made aware that the traditional knowledge base is not inferior to imported knowledge, and can play its rightful role in development" (Hill, Pernetta, and Rongap 1982, 357).

Use of traditional knowledge and resource-use systems in assessing compensation for loss of natural resources. Just compensation for damage to resources through modern developments (coastal hotels, dams, mines, administrative-social infrastructure, and so forth) requires knowledge of the total range and quantity of resources available in the areas subject to environmental impact.

Various approaches toward integrating traditional knowledge and custom into sustainable resource management also arose from discussions at the recent SPREP Conference in Port Vila and will be part of SPREP's forthcoming Action Strategy. In summary, they include:

A set of activities intended to encourage those people entitled to customary rights of ownership or use to continue or revive appropriate traditional resource-management techniques. These activities could include providing information about development options and consequences; investigation of alternative uses for resources, such as nature tourism instead of logging; community-based conservation areas; and the development of incentives to make traditional resource-management systems realistic in face of development imperative.

A set of activities aimed at government planners and large-scale developers to ensure that traditional knowledge and customs are not brushed aside in development projects but are incorporated as appropriate. These include such activities as building into environmental and social impact assessments an obligatory assessment of each proposed project's impact on traditional knowledge and resource use; the assembly, maintenance, and promotion of data bases on traditional knowledge and customs relevant to natural resources; and the institution of tribunals or other arbitration procedures to hear disputes between developers and customary rights holders.

A set of activities designed to alert and remind the general public of the value of traditional knowledge and customs. These awareness-raising activities would include the integration of traditional information into school curricula; the promotion of further research on traditional knowledge through scholarship awards; regional workshops and training courses; dissemination of traditional environmental information in popular forms; and development of display facilities relating to traditional knowledge in protected reserves.

Learning from the Past: Principles

Traditional knowledge and conservationist techniques can strengthen and enrich modern science and resource management. Progressing with the past can help in avoiding destructive environmental pitfalls while encouraging local communities to maintain and respect traditional approaches to the use of their environment. In the previous section steps that might encourage this integration have been suggested. But the pressures that act against or break down traditional knowledge and conservation techniques are likely to remain at least as strong as those that support them (Baines 1989; Klee 1980*a*). The steps toward what successes there are will mostly be faltering ones.

A less information-centered use for traditional ways is to extract from past ways of living some principles that might serve as guides to the present age, when the transformations of nature to human purposes bring ever greater and faster resource depletion and environmental degradation. This is not to suggest that present peoples live as their ancestors did. The Pacific's peoples "are *not* museum populations, nor do they wish to be" (R. W. Force, as cited in Klee 1980*a*, 273). Rather, certain past ways of living seemed to ensure more permanence and sustainability than present ways are likely to possess. In the traditional Pacific that sustainability was based on different premises from those underlying today's catch phrase "sustainable development," which is defined in *Our Common Future* as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development 1987, 43).

Our Common Future is a significant document in that it demonstrates clearly that environmental issues have finally reached the top of the world's political agenda. The commission that created the book says that it is serving notice that "the time has come to take the decisions needed to secure the resources to sustain this and coming generations" (World Commission on Environment and Development 1987, 2). This is nice rhetoric and it is heartening to read it in a document of such high credentials. It is less heartening to realize that throughout *Our Common Future* the emphasis is on the satisfaction of human needs—development—rather than sustainability. As only one example, in the chapter on industry, the commission noted: "Given expected population growth, a five- to tenfold increase in world industrial output can be anticipated by the time world

population stabilizes sometime in the next century. Such growth has serious implications for the future of the world's ecosystems and its natural resource base" (World Commission on Environment and Development 1987, 213). Indeed it does, even with more efficient and less polluting industry, especially when it is remembered that this growth would be on top of what has already been a sevenfold increase in industrialization since 1951.

To a region of small islands, such an assertion sounds like pure political rhetoric, not ecological reality. Notions of industrial expansion mesh badly with prominent characteristics of the traditional Pacific. Three concepts or principles drawn from traditional Pacific life and landscapes point toward a truer sort of sustainability than one based on the political necessity of continued material expansion. To demonstrate them, I shall follow the time-honored custom of using a reconstructed past to serve as an authoritative guide for the present. Although the Pacific past is not a perfect model for environmental sustainability through human management, it did possess immense knowledge of living resources and developed many sustained-yield subsistence systems. Its concepts of integration, limits, and beauty offer wisdom to the present.

Integration

Anyone who has lived in a traditional society knows how the economy is integrated into the whole landscape and daily life. The economy is not an abstraction that determines how the land and resources are used; it is not a method whereby human activities and the landscape are divided into abstract sectors of forestry, agriculture, industry, fisheries. The environment's immediacy and the absence of the distancing veil of money keep "economic factors" from driving people to environmentally damaging actions. To stress the holism of the landscape is not to say that it is homogeneous; it is made up of many component biotic domains—all finely known by the human inhabitants. But each of these domains is clearly part of a larger whole and none draws heavily on outside sources of matter or energy (other than the evenly spread gifts of rain and sunshine). Not using extrasystem inputs, the yields of agricultural systems were strongly positive in energy terms. In other words, the whole landscape of a particular human community was largely self-sufficient even though certain kinds of trade were well developed traditionally. Everyone in the community was aware of the ecosystemic processes taking place and aware that none could be exceeded without danger.

In the Pacific, this sense of integration was widely expressed. The Fijian term *vanua* serves as an example. Literally, it means "land," but it includes the social and cultural aspects of the physical environment identified with a social group. "It does not mean only the land area one is identified with, and the vegetation, animal life, and other objects on it, but it also includes the social and cultural system—the people, their traditions and customs, beliefs and values, and various other institutions established for the sake of achieving harmony, solidarity and prosperity within a particular social context" (Ravuvu 1983, 70). Its physical dimension includes gardening land, forest land, and fishing areas, a holistic view now more or less summed up by the concept of watershed, which is increasingly being recognized by modern resource managers as the essential unit of land management because what happens in one part of the watershed, especially upstream, affects the rest. Bad farming or deforestation hurts the reef. For the traditional community—with its roots in the whole area of the *vanua* —forest, garden, and reef were seen as tied to each other and to the human community through use and by common proprietary-usufruct rights. Recognized damage or waste by one person was condemned by all —along the lines of Garrett Hardin's solution to the tragedy of the commons: "Mutual coercion mutually agreed upon" (Hardin 1968).

Limits

Local self-sufficiency on clearly bounded small islands meant a consciousness of limits. The wider, modern world has been able to forget, temporarily, the idea of limits by drawing resources and energy from elsewhere, as the Pacific Islands do today. In small islands without significant imports, resources must be seen as productive capital producing further income. If the income declined per person because of population growth or absolutely because of degradation and depletion, Pacific Islanders understood that they had to think of depriving themselves rather than further abusing the environment. The famed characteristic of Pacific voyagers moving on to new lands rested in part on this recognition of limits in the original home island.

So too did the ideas of population control that have been described many times, as, for example, by Raymond Firth for Tikopia (summarized in Kirch 1984, 117–120). At the time of Firth's fieldwork in 1928, the Tikopia operated under a traditional Polynesian economic system and were acutely aware of the close association between population, resources, and the quality of life. "Not only is there a tendency for families to be regu-

lated in size according to the quantity of their orchards and other ground, but there is a conception of a total population for which food has to be provided" (Firth 1939, 39). "*Fakatau ki te kai* 'measured according to the food' " is a fundamental concept underlying a variety of cultural controls used by the Tikopia to maintain population at an acceptable level—acceptable not merely in terms of bare subsistence necessity, but in terms of culturally specified standards (Firth 1939, 43).

There were strong injunctions against what was seen as the antisocial behavior of producing families larger than the ideal of one male and one female child with their parents, for a larger family would exceed the productive capacity of their orchards. One *fono* (a ritually prescribed public address by a chief to the entire populace) ended with the following lines:

> The man who will persist in creating himself a family
> Where is his basis of trees he will create his family for?
> He will make a family merely to go and steal. (Firth 1967, 269)

Beauty

The clear recognition of limits points attention from quantity (the essence of materialism) to quality (the essence of beauty). Anyone who has walked about in a traditional landscape with one of its older inhabitants knows the enjoyment felt at the arrangement of productive diversity all around. Medicine here, perfume there, fiber in the hibiscus stem, fruit, timber, edible leaves, and so forth. There is a strong esthetic pleasure in these observations of utilitarian diversity. The pleasure is not for any wild or distant sublimities of nature untouched by humankind but for a designed Earth, a cared-for Earth of which humankind is very much a part. It is a feeling that we are in nature, not separate. Nature needs attention, grooming, and care, as we ourselves do.

Pacific poetry and song, past and present, express these feelings, as exemplified by the words of the Tongan writer and scholar Epeli Hau'ofa with reference to Tonga:

> Our songs are full of allusions to the beauty of nature. Our language is blessed with a great capacity for capturing the most subtle shifts in mood and the most minute changes in the state of the sky, the wind, the sea and the trees. The bodies of our dancers are adorned with leaves and flowers and anointed with the perfumed oils of life. All these things which provide quality and joy to our national existence and a richness and depth to our culture are based on our generously endowed land and sea. . . . [But] there is a strong probability that

within a few decades our environment will not be able to support the quality of life that we have known for generations. (Hau'ofa 1977, 34)

Conclusion

Many traditional techniques and aspects of traditional knowledge can and should be used in conservation and resource management today, for they have much to contribute. But in a world where the productive capacity of land and sea is expected to be infinite because human needs are seen to be infinite, the potential value of material lessons from the past is unlikely to be adequately realized. Better management derived from any source, past or present, is certainly called for in the effort toward sustainable development. But that development, like all human history, is a process of transforming nature. Our material, operational relations with nature, or the environment, are determined by our thought, images, ideals. If the primary ideal is to meet material needs—which quickly become infinitely expandable as desires—then humankind will devour the earth. Admonition, education, and technical procedures will not save us. Changed ecological ethics and esthetics offer more hope. The three tenets of traditional Pacific wisdom that have been briefly described here provide a different image of the relations of people to their environment. If those tenets—held in the mind today and valued because they were integral to the Pacific's past—can work to mold a new ethic relating people with their environment, then tradition will have given much toward a durable future.

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